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While the impact of technology has been considerable on those sectors of the American economy whose output consists of volume production (e.g., agriculture, manufacture, and mining), it has been relatively small on the service sector, where two-thirds of all Americans make their living. Trends which should be taken into account by curriculum planners include the large shift in the American labor market to a service-oriented economy, the increasing number of adults who change careers in the middle years, the vast number of Americans who work less than full time, and the rising importance of avocations to people whose vocations are financially but not personally satisfying. Special attention needs to be given to the development of curriculums for the culturally disadvantaged, to the discovery of ways to motivate learning, to determining ways to develop talents and interests largely neglected (e.g., artistic), and to improve articulation between the educational choices of high school students and their later lives. (JK)

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TECHNOLOGY and the CURRICULUM

Paul W. F. Witt
Editor

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TECHNOLOGY AND THE CURRICULUM contains addresses presented at the Curriculum Conference at Teachers College, Columbia University. Participants analyze the vast changes resulting from our advancing technology and suggest what the educator's response should be. A central theme is that the use of technology in education is inevitable and highly desirable provided that the teacher and curriculum specialist play a central role in its design and use as a humanizing factor.

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Editor's Preface

The Teachers College Department of Curriculum and Teaching chose "Technology and the Curriculum" as the theme of its 1967 Curriculum Conference, the fourth in its present biennial series. The department made this choice recognizing the significance of technology in education and believing that curriculum specialists can and must play central roles not only in the design of educational technology but also in the construction of curricula that will enable young Americans to cope successfully with their technological age. The papers read at the conference are presented in this publication.

The conference program was designed so that the opening presentation would provide an analytical view of technology and make visible its ever-expanding and increasingly powerful influences. This Alice Mary Hilton accomplishes in her brilliant dissertation on cybernation and its impact on American society. She challenges educators and lay citizens to help man achieve true independence so that he may become "Man, the Creator." Her paper makes clear that technology, if properly controlled, can be a humanizing rather than a dehumanizing factor.

A more sharply focused view of technology's influence on present-day society—its impact on economic systems—is presented by Eli Ginzberg in his authoritative statement on manpower needs. Professor Ginzberg delineates the educational implications of these needs, particularly with reference to the education of the disadvantaged and the continuing education of adults, and emphasizes the importance of appropriate and effective school curricula. Professor Ginzberg's allegation that many schools fail to perform effectively and his contention that society must assess their output and hold educational authorities accountable for this output merit very serious consideration.

The role of the knowledge industry in responding to society's demand for a more relevant education is described by Robert E. Slaughter. His recognition of the knowledge industry's dependence on professional educators and his belief that the development of educational technology requires a partnership of industry and education denies current fears of an industry take-over in education. For the future Mr. Slaughter sees greater use of computers to individualize

learning, an expansion of the systems approach in instruction, and a greater use of communications technology.

The central and strategic role of teachers, curriculum specialists, and professors of education in the advancement of educational technology and the necessity of preparing teachers to use the new technology are themes discussed by Paul W. F. Witt. He stresses the importance of the contributions instructional materials specialists can make in developing media resources and in educating teachers to use them. Noting the shortage of media specialists, Professor Witt urges his fellow educators in curriculum and teacher education to help clarify the role of media specialists and to lend their support to the development of more effective programs for preparing these specialists and to the recruitment of promising young people to work in this area.

To provide conference participants with a historical perspective of the field of curriculum Herbert M. Kliebard was invited to read a paper on the development of curriculum theory. Professor Kliebard presents a fascinating and informative account of the views of curriculum which have emerged since 1893. His analysis of the effect of the criterion of social utility on curriculum development coupled with his discussion of the closely related dichotomies of the academic and the practical subjects and of college preparatory and non-college preparatory pupils offers a highly useful frame of reference for assessing present and evolving theories of curriculum and educational technology.

Robert M. W. Travers notes that a sound technology of education cannot be developed either on the basis of evolving practical experience or by borrowing from other areas but must be grounded on scientific knowledge regarding learning. He points out the limitations of using the research on operant conditioning as the sole basis for developing educational technology and suggests additional sources of knowledge, including several illustrative psychological concepts, which should be considered in designing new media. He decries the use of new media to achieve traditional goals and urges, most wisely, that the new technology be related to new objectives. He is pertinently critical of efforts to employ the new technology to speed up learning, especially the kind that takes place in most schools. Rather, he maintains, educators should be seeking ways to help people make better use of knowledge and to learn to use knowledge-storing devices effectively and efficiently.

Joseph C. Grannis, in an essay on which his conference presentation was based, describes three models of society represented in schools—the family, factory, and corporation. Holding that none of these is suitable for today's schools, especially for those serving the

disadvantaged, Professor Grannis argues for a major modification of the structure and operation of schools so that they may serve both the individual and the community more effectively. He offers specific suggestions as to how this might be accomplished.

The influence of educational technology on the curriculum specialist's role is made evident by Neil P. Atkins in his description of the efforts of a middle school faculty to find ways to use a dial-access installation to individualize instruction. As the curriculum specialist in this situation, Dr. Atkins learned that the most productive approach was to involve the teachers directly in the task and help them discover for themselves how to use the new equipment. Dr. Atkins' experience in this project led him to attach top priority to inservice teacher education and the creation of an adequate supply of appropriate materials as tasks of the curriculum specialist in the development of educational technology.

Maxine Greene accepts the irreversibility of the advance of educational technology and indicates no desire to dispute the advantages claimed for the new instructional media and devices. But, with the humanist's point of view, she insists that both the "person-centered" perspective and the machine model are essential for explaining teaching and learning and for curriculum making. She leaves no doubt that the teacher, not the technology, must always be in charge.

Appreciation is expressed to the many people who had a part in the conference. In addition to the speakers, special thanks is extended to Roma Gans, Alice Miel, and Dwight Teel for their participation in the panel discussion that followed Alice Mary Hilton's speech. Grateful acknowledgement is made of the assistance of conference members who served as discussion leaders and the doctoral candidates in Curriculum and Teaching who served as recorders and assistants. Arno A. Bellack, Bruce R. Joyce, Dorothy M. McGeoch, Kenneth D. Wann, and Alice Miel were centrally involved in planning the conference. They and other members of the Department of Curriculum and Teaching also helped in many other ways. Important contributions were made by Helen G. Hardy and Kathy Carn. The efforts of all these colleagues are greatly appreciated.

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Manpower Needs in a Technological Society and Their Implications for Education

ELI GINZBERG

There are different ways into the problem of technology. It all depends on whether one starts with a predisposition to be overwhelmed by technology, to be impressed with it, to be willing to consider it, or to avoid it. I take a somewhat cautious stance. One reason is that in my student days at Columbia there was a group of people known as the technocrats, part of the engineering faculty located in the School of Mines and next door neighbors of mine. They had a vision of the world to be. They have disappeared completely, and I occasionally wonder how many of the present prophets of the new technocracy, eloquent and assured, are also likely to disappear without a trace.

THE IMPACT OF TECHNOLOGY ON THE AMERICAN ECONOMY

I don't know much about "brave new worlds," but I will try to point out certain changes in American life, certain transformations of the American economy, that ought to have some impact and significance for school people.

Let me begin by saying that technology has had its greatest impact upon economic systems where the output consists of turning out the same item in large amounts. The greatest development of technology

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in the American economy has not been in manufacturing but in agriculture. People forget that. Manufacturing and mining come next. The place where technology lags to a considerable extent is in many areas of the services, and ours has now become an overwhelmingly service economy. Two-thirds of all Americans make their living in the service sector. Only one out of every three workers in the United States is employed in agriculture, manufacturing, mining, and construction, that is, in goods-producing. Thus, if you view the problem in this manner, you begin to be a little cautious about the future application of machinery since the places where it can be most easily absorbed have already been heavily affected.

The next point is that the word "technology" is usually too inclusive. Its various meanings have to be sorted out. If technology means the application of capital to improve processes and to improve products, then it is distinct from organizational changes. Let me give an illustration. I serve as the chairman of the National Manpower Advisory Council. We had a meeting in Chicago a few years ago, which was attended by a vice-president of Montgomery Ward. I asked him to tell me about the extent to which they were facing new automation. "Well," he said, "we've completed putting the computer into our credit collections. But the important point as far as manpower saving is concerned, is that we are changing the structure of our stores, making them increasingly self-service, arranging to have customers take goods off the shelves and come to central points for payment and wrapping." He added, "We believe that we will make considerably more gains in manpower from this organizational change than we have made by introducing fancy computers into the white-collar part of our operations." Such changes have little if anything to do with technology, but a great deal to do with management and organization.

If you read what I call the "science fiction" materials about what is going to happen in medicine, a field in which I am deeply involved, you learn about all the wonderful diagnoses that are going to be made because every patient will be tied in to some kind of an electronic system and great professors somewhere will read evidence, make appraisals, and give advice to local physicians. As far as I am concerned, that is really science fiction of a high degree. The kinds of good things that may happen in medicine have little if anything to do with technology, but relate rather to the organization and delivery of medical services. As I was involved in structuring and restructuring the medical service of the armed forces in World War II, the last thing with which I was concerned was technological change. The key challenge was to improve the resources that one had available.

If technology is broadened to include all changes, it really is not a useful concept. If it is delimited to mean simply the application of new forms of capital to improve the production of goods, one has to be a little cautious in a service economy about how far it will be pushed. Even in manufacturing, technology is not a revolutionary force. It still takes DuPont something like fifteen years, in a cycle that starts with investigation and discovery in the laboratory, to develop a new consumer product. And consider, for example, our so-called dynamic automobile industry. Nothing much has happened over the years except improved style and comfort. Cars really haven't changed at all, except perhaps for the worse in the sense that they have greater speed so we can now kill more people. And nothing has really happened in over thirty years in the basic technology of American education (except possibly paperback books). So you have to be very cautious when you become tremendously impressed with the so-called new technology.

It is true that we have had a revolution in air travel. No question about it. We have had revolutions, slower ones, in textiles, in the substitution of synthetic for natural fibers. We have also had many important applications of existing technology. For example, air conditioning now makes it possible for people to work twelve months of the year in the South rather than five or seven months. Such technological adaptations which lead to transformations are very important.

But I remain very restive about how much technology can help us with respect to our major problems. Maybe someday we will learn how to build a house inexpensively, but we haven't been able to yet. Urban renewal and metropolitan reconstruction have very little to do with technology, per se. We just passed an enormous bond issue for new roads which will probably compound our problems. I voted for it but with great reluctance because it will probably just increase the traffic into the cities and out of the cities, and we will probably choke to death faster. In addition technology seems to be worsening rather than improving the problems of our racial minorities. And it has done nothing to increase life expectancy for males by a single year over the last decade. Although women keep on living longer and longer—like generals, they just fade away—men keep dying young.

I have disclosed my basic skepticism about the marvels of technology. Now I will mention some of the important trends that I see ahead.

TRENDS IN THE AMERICAN ECONOMY

We are now growing all of our food in this country and even have a considerable amount for export. With a farm labor force on the order of four million, that is 5 per cent of a total labor force of eighty million, we grow all of our own food and some extra. The serious agriculture in this country is really large-scale industry; it is agro-business. This means that a successful farmer has a capital investment of $100,000 to $200,000, and there is very little place for what we used to know as the independent, small-scale farmer. There are still a couple of million small farmers, for we have not followed Mr. Nixon's mis-spoken suggestion in the 1960 campaign to plow the farmers under to solve the agricultural problem. While that came as close to being a good answer as I know, it is not a very easy one to implement. So we still keep an extra two million or so farmers on the farm because we don't know what to do with them, even though we don't really need them there.

The next point worth mentioning is that the number of non-farm laboring jobs has diminished so rapidly that the kind of a labor market we had at the turn of the century has disappeared. In those days, when a shipload of immigrants came into New York, recruiters went down to the pier for men with muscle. The typical screening device was "Roll up your sleeve." If a fellow had muscle, he was hired; if he didn't, he wasn't. Nobody was interested in whether he was literate. Nobody cared if he knew English. No one gave him an I.Q. examination. At that time our economy was able to absorb a tremendous amount of brawn. Today we have less and less need for it.

But we do not disregard brawn completely, and this leads us to the third point. In the amorphous but very large sector known as service, which covers everything from trade through medical services and education, we have tremendous variability in terms of the labor that is employed. Only think of a modern hospital which at one end of the service spectrum has the neurosurgeon, who after medical school probably had to devote at least seven years to post-graduate education in order to pass his boards, and at the other end has the sweeper, who has no requirements at all except to be able to stand upright. It is really impossible to make any short, concise statements about the whole service area.

There was an interesting occurrence in Chicago some time ago, when the Commissioner of Welfare discovered that the taxi companies needed a large number of drivers and were unable to get them. There

were a large number of young men on welfare, and the Commissioner discovered that the reason they couldn't drive taxicabs was that they were illiterate to the point of not being able to enter the minimum amount of information in the log books required by the police. But with about eight weeks of instruction a thousand men were taken off relief and made taxi drivers. There is a lot of this kind of slippage going on in the economy at this moment; that is, with very small adjustments many who are presently unemployable could become employable.

The difficulties of urban living are responsible for keeping some people unemployed. To illustrate, I remind you that we had a blackout in New York City not so long ago, and it turned out that thousands of people were stranded on their way home. They couldn't get home because they only knew one way of getting from home to work and work to home, and when that was blocked they were like Livingstone in darkest Africa. They panicked. They sat down and didn't move. Now if that seems strange, let me say that there are probably thousands of people in New York at this moment who cannot look for a job except within the radius of the area where they are able to walk. They can't cope with the modern city at all. They can't read the signs. They don't have enough self-confidence to negotiate the subway system. They are just trapped within their neighborhoods.

Another problem that we have is that we are becoming a society in which one cannot maneuver unless he has the basic credentials. Everybody has to have some kind of a record—or the absence of a record. One of the most serious matters that plagues the disadvantaged is that many had scrapes with the police when youngsters. That means they may have a police record, and large-scale industry and sometimes small-scale industry say they don't want any delinquents or criminals. Nobody takes the time to look at the nature of the infraction. It may be no more than having been in a civil rights parade. Thus, if you have a record you have a hard time getting a job. In the follow-up study of Watts after the riot it was found that a tremendous number of Negroes were stranded in Watts because they couldn't get driver's licenses, one of the basic credentials. Because of some infractions they had had their driver's licenses revoked, and Los Angeles is a miserable city to get around in without a car.

The next point I want to make is that as the society and the economy become more affluent a lot of people change careers in middle years. At Columbia I see more and more grey-haired and not so grey-haired gentlemen who want to start new careers or shift fields. In fact my colleague, Professor Dale Hiestand, has just finished a book for the

Russell Sage Foundation called *Changing Careers in the Middle Years*. This shifting means that the educational system has to confront a new set of demands for the first time. We are not talking of only a few people but about a large and growing number.

We normally think about the labor market in terms of employed people, unemployed people, and people who do not work for a living. But that is too simple. Somewhat over eighty million people worked in the United States some time during the course of 1966. Over forty million of them worked less than full-time or did not work the entire year. The dichotomy that we use between a man who is either working or is unemployed is much too simple. We have a tremendous number in what we call the peripheral work force. Boys and girls go to school *and* work. Women keep house *and* work. Older men begin to retire but *still* work. There is a tremendous amount of in-ness and out-ness that statistics do not reflect. And the opposite is that some people hold down several jobs. So we carry around images which aren't really congruent with the facts.

My next point is that the American economy has been absorbing very large numbers of college and graduate students and paying them more and more money for their first job. Frankly, I don't understand how they justify these high salaries. Every year the opening bids for a young man whose only credential is a college or graduate degree go higher. In our school, a man with a master's degree now gets an opening bid of about $11,000 to $12,000. Now I know that most of them are not worth nearly that much, but I know they are getting these handsome sums. How long is this going to continue, this tremendous absorptive capacity of American business for educated people? I don't know, but I have some hunches as to what lies behind it.

The opening wage is not a clue as to what a man is going to earn in ten and twenty years. What is happening, I believe, is that tremendous competition on the part of large companies for talent is leading them to pay a big price to get a look at the talent. After having done so, they let many move only very slowly ahead. Engineers' salaries five, ten, and fifteen years later tend to be no more than 25, 30, or 35 per cent above the opening wage. Many educated people in large organizations are dissatisfied, not only because of the failure to gain substantial increases in salary, but also because their skills are under-utilized.

Now, interestingly, there is a group below the college level, on the technician's level, which is very small at the present time. I suspect, however, that junior colleges, which look to me to be the most exciting development in American education since they give men and women a chance to go to work before their hair turns grey, may help to

swell the supply. Although I am quick to admit that some junior colleges are simply transition routes for senior colleges, many others, hopefully, will address themselves to terminal education.

Accelerated advances in knowledge and technology point up the need for continuing training and retraining, education and reeducation of the existing work force. The educational process is no longer a one-time affair through which a person passes early in life. Yet, there are several states that prohibit public school monies to be used for the education of adults.

The final general point that I want to make concerns the consequences of affluence. Let me first mention that 38 per cent of all Negro families outside of the South have $7,000 or more income per year. One must not get the idea that all Negroes are starving to death. They may be miserable in the ghettos. They may have untold claims against the white society, as I think they do have, but most of them are not starving to death. In an affluent society in which large numbers of people have sizable amounts of disposable income you have to reckon with the fact that many may be only slightly interested in their jobs and much more concerned about the quality of their lives off the job. I suspect that for very large sections of the American population, particularly in the younger age groups, many people get more fun out of their avocations than they do out of their vocations. I have seen many people more excited about their sailboats than about their work. If you are an assembly-line worker, how excited can you get about your work? It is a very tiresome job. You have little prospect of being promoted. Why shouldn't you be more interested in your life off the job?

Thus the major adjustment necessary is to align educational opportunities to the needs of adults. I have already pointed out that many men will be changing careers in middle life. Women, too, require a new type of educational opportunity. Roughly one-third of our labor force is made up of women, 60 per cent of whom are married. About half of all women between the ages of forty-five and fifty-five work for pay. That suggests that a large number of women enter the labor force for the first time or reenter it in their thirties and forties. Yet we have an educational system that is not really attuned to this.

IMPLICATIONS FOR THE CURRICULUM

Now what does all of this mean for curriculum construction and reconstruction? I can only emphasize what is already recognized—that if we don't learn how to teach every child in school how to read

and write and handle numbers we are really shortchanging our children in a most serious fashion because ours is a reading-writing-and-number society. And if one has to be reeducated and retrained, one will be hopelessly handicapped without these basic skills. One of the things that we learned in operating the Manpower Development and Training Program was that a large number of people could not be sent into skill training because they lacked the minimum educational foundation.

Dr. Fischer, the president of this institution, has said, not once but repeatedly, that the American public schools do a very good job with two-thirds of the population but that they have never faced up to nor solved the problem of educating the disadvantaged, the lower third of the population. I don't know what it's going to take to do that. It is perfectly clear to me on *a priori* grounds that the fact that youngsters come from disorganized homes is no reason why they should not be able to learn to read and write. Everybody blames somebody else: the teachers say it is the fault of the home; parents say it is the school that is at fault. This sort of game is going to get us nowhere. We just have to postulate that this is a job that can be done. There are no *a priori* reasons why poor youngsters from disturbed homes can't learn to read and write and learn to do arithmetic even though the schools haven't learned as yet how to teach them. I know that we did it in World War II. We trained, in very short order, six hundred thousand illiterates without any real trouble because we had a proper structure. We had people who wanted to teach them, and people who wanted to learn. I would say that a six-year-old wants to learn, and we must quickly discover how to teach him. More sophisticated discussions of curriculum are pointless until this basic issue is out of the way. I suspect that teaching the disadvantaged is tied to basic problems of the ghetto including the ghetto school and the lack of control of ghetto people over their own lives.

Now the second problem that arises is that even if youngsters learn how to read, write, and do arithmetic, there comes a point, around puberty or early adolescence, when many lose interest in books. They are the non-bookish types, even if they have gained control over basic skills. That is, they don't read easily and they don't deal with abstractions easily, and we have never been able to develop a secondary school appropriate for these non-bookish types. We don't know what or how to teach them. Yet, there is no *a priori* reason why one should not be able to get them to learn some mathematics by relating it to what goes on in a shop or to develop their reading skill by relating the materials to subjects in which they are interested. The vocational schools

clearly don't do this. We have not learned how to structure a learning situation suitable to the needs of the non-bookish part of the population—and it is a considerable part. I suspect that it has to do with the fact that it is very hard to get adolescents to learn unless they see the purpose of learning. With very young children the authoritarian figure of the teacher may get them to learn, but adolescents have to be teased into learning. And that means that exclusive emphasis on classroom instruction is probably wrong. I suspect that if we were able to splice the school and work situations so that youngsters had an opportunity to see for themselves the relation between knowledge and advancement they might become more interested in their studies.

The next problem that bothers me greatly about the curriculum is what I would call anachronisms relating to sex differences. The fact that we have commercial programs for girls, which in many instances simply underwrite employer costs for low level work, is often selling the girls much too short. I would say that while there undoubtedly are different patterns, interests, and possibly even different attributes for boys and girls, the overlap between the sexes is even more significant. If a certain type of education is good for boys it is likely to be good for most girls. Many girls today are getting an inferior high school education: home economics, commercial, and distributive courses.

Another problem is that our school curriculum has never been able to foster certain kinds of talents and interests because we substantially neglect whole areas, such as the artistic and the esthetic, where there are a lot of jobs. It is very difficult except in very large and well supported systems to develop the ability of youngsters in these areas.

Regarding the curriculum, I am also bothered by the poor choices that many make from the options available to them. The role of curriculum as a guidance instrument has not been fully appreciated. I have a very simple rule: Nobody gets off the academic track without proof that he cannot perform on the academic track, because that is the track that opens up the greatest number of options in our type of economy. Only if students experience trouble with academic subjects should they be permitted to follow alternatives.

I would like to see much more articulation between the choices of young people in high school and their later lives. For example, many young men enter military service. They have little or no perception while in high school of how their current behavior is related to what will happen to them in military service. But it would be desirable to make them aware of these linkages, for if they were, their work in school might be more meaningful to them. A big plaint of many

youngsters is "What's the use? What's the relevance? I don't need this. I don't want that." So one need is to bring the reality which they will soon confront closer to them.

The articulation question also affects adults. I am very bothered about graduate schools of social work. A youngster who graduates from college at twenty-one or twenty-two and goes on immediately to graduate studies in social work masters the same curriculum that is offered a married woman of forty who has brought up three children and who has been active in community affairs. This is silly. There must be some part of standard curriculum that is grounded in experience and maturity and that should be modified in the case of older students. But in our credential-mad society this doesn't happen.

Let me recapitulate: The school is one part of a larger learning experience. It is the most important part because it is the key skill-acquiring center. One can't keep on learning unless he masters initially what the school has to offer. But regrettably many schools fail to deliver, and people fail to acquire the skills they need. It is clear to me that we must audit the performance of the schools and hold the educational authorities responsible for their output. I am much less interested in input than in output. Until one demands that a system deliver, it is likely to avoid the difficulties and explain away its failures.

I have suggested the importance of curriculum in connection with guidance. The question of how one restructures the high school so that it does a better job with respect to the non-academic group is pressing, assuming of course that the elementary school has done its job. Finally the necessity of thinking about curricula for adults is a new challenge.

Basic skills for the young; appropriate instruction for the non-bookish in high school; new and informal curricula for adults—this is my understanding of the curriculum challenge.